DOCUMENT RESUME

ED 097 667 CS 001 435

AUTHOR Underwood, Benton J.; Reichardt, Charles S.
TITLE Implicit Associational Responses Produced by Words in Pairs of Unrelated Words.
INSTITUTION Northwestern Univ., Evanston, Ill. Dept. of Psychology.
SPONS AGENCY Office of Naval Research, Washington, D.C. Personnel and Training Research Programs Office.
PUB DATE Aug 74
NOTE 25p.

EDRS PRICE MF-$0.75 HC-$1.85 PLUS POSTAGE
DESCRIPTORS *Association (Psychological); Cognitive Ability; *Cognitive Processes; *Educational Research; Learning Processes; *Memory; *Paired Associate Learning; Word Recognition
IDENTIFIERS *Implicit Associational Responses

ABSTRACT

The purpose of this study was to determine if implicit associational responses (IARs) occur to individual words presented as pairs for associative learning. The occurrence of IARs was determined by a YES-NO recognition test, and IARs for words presented singly for study provided a base line. For all condition, false recognitions to assumed IARs occurred; the magnitude was equivalent for words presented for study as pairs as for the same words presented singly. No evidence was found that IARs occurred during the testing phase. (Author)

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

CS

Implicit Associational Responses Produced by Words in Pairs of Unrelated Words

BEST COPY AVAILABLE

Benton J. Underwood and Charles S. Reichardt

Northwestern University

BEST COPY AVAILABLE

August 1974

Project NR 154-321
Sponsored by
Personnel & Training Research Programs
Psychological Sciences Division
Office of Naval Research
Arlington, Virginia
Contract No. N00014-67-A-0356-0010

AS 001 435

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Implicit Associational Responses Produced by Words in Pairs of Unrelated Words		5. TYPE OF REPORT & PERIOD COVERED Technical Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Benton J. Underwood and Charles S. Reichardt		8. CONTRACT OR GRANT NUMBER(s) N00014-67-A-0356-0010
9. PERFORMING ORGANIZATION NAME AND ADDRESS Psychology Department Northwestern University Evanston, IL 60201		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 61153N; RR 042-06 RR 042-06-01; NR 154-321
11. CONTROLLING OFFICE NAME AND ADDRESS Personnel and Training Research Programs Office of Naval Research (Code 458) Arlington, VA 22217		12. REPORT DATE August 1974 13. NUMBER OF PAGES 18
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Submitted to Memory and Cognition

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Recognition Memory

False Recognition

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The purpose of this study was to determine if implicit associational responses (IARs) occur to individual words presented as pairs for associative learning. The occurence of IARs was determined by a YES-NO recognition test, and IARs for words presented singly for study provided a base line. For all conditions, false recognitions to assumed IARs occurred; the magnitude was equivalent for words presented for study as pairs as for the same words presented singly. No evidence was found that IARs occurred during the testing phase.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

ED 097667

Implicit Associational Responses Produced by Words in Pairs of Unrelated Words

Benton J. Underwood and Charles S. Reichardt

Northwestern University

August 1974

Project NR 154-321
Sponsored by
Personnel & Training Research Programs
Psychological Sciences Division
Office of Naval Research
Arlington, Virginia
Contract No. N00014-67-A-0356-0010

Approved for public release; distribution unlimited.

Reproduction in whole or in part is permitted
for any purpose of the United States Government.

Implicit Associational Responses Produced by Words in Pairs of Unrelated Words

Benton J. Underwood and Charles S. Reichardt

Abstract

The purpose of this study was to determine if implicit associational responses (IARs) occur to individual words presented as pairs for associative learning. The occurrence of IARs was determined by a YES-NO recognition test, and IARs for words presented singly for study provided a base line. For all conditions, false recognitions to assumed IARs occurred; the magnitude was equivalent for words presented for study as pairs as for the same words presented singly. No evidence was found that IARs occurred during the testing phase.

Implicit Associational Responses Produced by Words in Pairs of Unrelated Words

Benton J. Underwood and Charles S. Reichardt

Northwestern University

The question to which the present experiment was addressed was as follows: "Do implicit associational responses (IARs) occur to the members of pairs of unrelated words in a manner comparable to that for single words?" This question was prompted by two considerations. First, in verbal-discrimination learning, where pairs are presented for study, expectations based on the assumed occurrence of IARs have been given weak support at best (e.g., Kanak, Cole, & Eckert, 1972; Underwood, Reichardt, & Zimmerman, 1973). This could mean that, for whatever reason, when the subject is faced with pairs of words on a learning task the production of IARs to those words is depressed. Although IARs appear to occur to individual words in sentences (e.g., Hall & Crown, 1972), it does not necessarily follow that such production will occur with the words in pairs of unrelated words.

The second reason for conducting the experiment is a more general one, namely a concern with paired-associate learning. Most investigators seem to accept the notion that the learning of at least some pairs of unrelated words in a paired-associate list involves the use of natural-language mediators. Subject reports of such mediation have been far too frequent to dismiss the idea. Yet, there are some studies in the literature (e.g., Schwartz, 1969) which suggest that mediators in paired-associate learning do not occur with the spontaneity that

might be expected; instructions to the subject to seek them are often necessary for a clear influence to emerge. However this may be, there has been no test made of IARs to words in pairs and the present study will fill this gap.

This study utilizes false recognitions to detect IAR production. In the critical conditions, the subject was first presented pairs of words for study. Subsequently, his recognition for the individual words was tested, and included in the test was a high associate of one of the words of the study pairs. Thus, if the pair presented for study was spool-climb, the recognition test included the word thread which is a high associate of spool. The number of false alarms on these assumed IARs was compared with the number which occurred when the words were presented individually for study. Therefore, the first variable of interest was the method of presentation on the study list, pairs versus single words.

A second variable was instructional in nature. In one case subjects were told to associate the two words in the pair, just as would be true for paired-associate learning. In the other case, the instructions informed the subject exactly how he would be tested for each word as a single word. The effect that instructions have on the manner in which a subject goes about the learning is difficult to gauge, but it was believed that these different instructions represented two extremes of possible instructions.

A third variable was the position of the word in the pair to which

the assumed IAR occurred. In the pair spool-climb, the IAR to the nominal stimulus term was tested. However, tests for the same IAR were made when the inducing word occupied the nominal position of the response term (climb-spool).

Finally, the recognition test was so arranged as to be able to determine if IAR production occurred during the test phase.

Method

Materials. Forty pairs of words representing the stimulus word and the primary response to that word as observed in word-association procedures were brought together. The pairs were from the unpublished Connecticut norms. The primaries ranged from 47% to 91%, with the average being 65.4%. For each stimulus word another word was found which had been given by no subject as a response to the stimulus word, and this word was paired with the stimulus term to represent unrelated pairs. Thus, climb had not been given by any subject to the word spool in the word-association procedure. These neutral words were always taken from the responses given to other stimulus words in the association tests.

The 40 sets of three words each (spool, thread, climb) constituted the critical words. Primary associates may be good candidates for false alarms whether their stimulus terms were or were not presented for study. It was necessary, therefore, to use primary associates as control words (C Words) in determining a base rate of false alarms against which to measure IAR-produced false alarms. The 40 sets were

divided randomly into two sets of 20 each. The pairs of words in one set were presented for study but not those in the other. The presumed implicit associates (e.g., thread) were tested for false recognition (E words) and the associates from the other set became the C Words. Across forms, both sets served both functions. The characteristics of the study lists may now be more precisely specified.

Study lists. It should be clear that in no case were known associated words presented for study. High associates to words presented for study were used only on the recognition test. The list of pairs presented for study included the 20 critical pairs of zero-associated words. Half the time the stimulus word for the primary associate was the left-hand or nominal stimulus term (S Term), and half the time the right-hand or nominal response term (R Term). Two neutral pairs were used at the beginning of the list and two at the end. In addition, to make the learning task longer, if not more difficult, 20 neutral pairs (neutral with regard to test plans) were included within the body of the list but these words were never tested. The 20 critical pairs were assigned randomly to positions within the list and the remaining 20 positions were filled with the neutral pairs.

When the study list consisted of single words, the words in the pairs were simply ordered sequentially, hence an 88-word list resulted.

In order to have each critical stimulus term serve as an R Term and as an S Term, and in order to have the two sets used in the study lists half the time and as C-Word sources half the time, four forms

were required for the study lists.

Test Lists. The test list consisted of 80 words presented singly, with the subject requested to make a YES-NO decision on each. These 80 words consisted of the 20 E Words (presumed IARs to words presented for study), 20 C Words (presumed IARs to words not presented for study), and the 40 words constituting the critical words which were presented either in pairs or as single words during the study list. Thus, on the test, there were 40 true old words, and 40 true new words, although, of course, the latter included IARs to study words.

The ordering of the test list was such that the IAR inducing stimulus words, e.g., spool, were tested half the time before the IARs (thread) were tested, and half the time the reverse was true. This allowed a determination of any influence of test-produced IARs on performance. Within this restriction, the order of the words on the test list corresponded to, but was not exactly the same as the order on the study list. This tended to keep the retention interval equivalent for all words in the study list. Within the test order, C Words were interspersed randomly. Two test forms were necessary, one for each of the two groups of 20 sets of critical words.

Procedure, instructions, subjects. The 44-pair study list was presented at a 4-sec. rate on a memory drum; the 88-word study list at a 2-sec. rate so that total study time was equivalent for both types of lists. The instructions prior to learning differed for the four groups as follows:

Pair-A. This group of subjects was presented pairs of words for study, with instructions to associate (A): "A list of pairs of words will be presented to you on this machine. You are to learn these pairs by asscciating or connecting the words in each pair. After you have seen all of the pairs, you will be tested; but I will tell you more about the test after you have studied this list."

Single-A. This group of subjects was presented single words under instructions to associate words: "A list of words will be presented to you on this machine. You are to learn these words by associating or connecting the words in the list to each other. After you have seen all of the words, you will be tested; but I will tell you more about the test after you have studied the list."

Pair-NA. The subjects in this group were given what will be alled nonassociative (NA) instructions: "A list of pairs of words will be presented to you on this machine. After you have seen this list you will be tested. On the test, a list of single words will be presented. Your job will be to decide which are old words, that is, words which occurred in the study list. For each word, you should respond 'YES' if it was presented in the study list and 'NO' if it was not presented. You will be required to respond to each word, guessing if necessary."

Single-NA. The instructions were the same as for Pair-NA except that they were told a list of words was to be presented rather than a list of pairs of words.

All groups were given YES-NO instructions prior to the test, these being essentially repetitions of the instructions given prior to study to the NA groups. The subjects were informed that they must make a decision for each word within the 3-sec. period allowed. In the few cases where a subject did not respond, the word was shown again after all others had been shown and a decision requested.

There were 40 undergraduate students placed in each of the four groups by a block-randomized schedule which included forms. Forms were a balancing variable and will not be included in the analyses since their inclusion did not change any decisions concerning the influence of the major variables.

Results

False recognitions. The critical data consist of the number of false recognitions made to the E and C Words. These are shown in Table 1, organized with regard to instructions and whether the study list consisted of pairs or of single words. The values represent means for 40 subjects where each subject was given 20 E Words and 20 C Words. The statistical analyses which will become a part of the evaluation of the data in Table 1 also included the variable of whether the IAR was tested before or after the inducing word. However, the effect of this variable will be considered later.

The first fact to be noted is that more errors were made on E

Words than on C Words by the subjects in all of the four groups, F (1, 156) = 39.72, $p < .01$. This finding is taken to indicate that false recognitions were produced as a consequence of IARs occurring during the study of the list. However, neither instructions nor the nature of the study list had an influence, the Fs in both cases being less than one. As may be noted, the difference between the means for the E and C Words was roughly constant for all four conditions; this was reflected in the lack of interaction ($F < 1$) among the three variables. However, the interaction between instructions and type of study list (summing across E and C Words) was significant, F (1,156) = 6.47, $p < .02$. With A instructions, more false alarms occurred when the words were presented singly during study than when presented in pairs, and the opposite was true following the NA instructions. It should be repeated that these conditions influence false alarms on C and E Words alike; there is no evidence that IARs were reduced when words were presented as pairs for study, nor any evidence that instructions influenced the number of IARs. These two variables did influence the tendency to accept new words as old, but the influence was equivalent for the E and C Words.

IAR effects on test. Half the E Words were tested before their eliciting stimulus was tested, and half were tested following the test for the eliciting stimulus. If the same IAR was produced by the eliciting stimulus during the test as during the study, more false recognitions on the E words should occur when the eliciting stimulus

Table 1

Mean Number of False Recognitions for Each of the Eight Combinations of Three Variables: Pair versus Single Words in Study List; Associative (A) versus Nonassociative Instructions (NA), and C versus E Words. The Standard Deviations are Shown in Parentheses.

Single Words				Pairs of Words			
A		NA		A		NA	
C	E	C	E	C	E	C	E
3.58	4.58	2.65	4.03	2.23	3.63	3.48	4.98
(2.98)	(2.85)	(2.53)	(2.86)	(2.40)	(2.66)	(2.71)	(3.45)

was tested first than when tested second. The differences were as expected by this conception, but again the effect must be evaluated by also looking at changes during the test in the false alarms to the C Words. Thus, to conclude that false recognitions were increased during the test as a consequence of IAR elicitation earlier in the test requires that the increase in false alarms for the C Words not be as great as was the increase for the E Words. This interaction was not present ($F = .96$). Thus, the increase in the number of false alarms occurring across the testing phase was general.

S Term versus R Term. For half the pairs during study the eliciting word for the IAR was in the stimulus position, for the other half it was in the response position. The results for the two groups of subjects presented pairs for study were analyzed to determine the effect of this variable. The mean number of false recognitions to IARs to the S Terms (2.16) was slightly larger than for the number of false recognitions to IARs of R Terms (2.12), but this difference was not reliable, ($F < 1$).

Old words. The old words consisted of the 20 words presumed to elicit IARs and the 20 neutral words with which they were paired, or which occurred in succession when the words were presented singly. The number of misses on these old words varied between 28.4% and 33.1%, but there was no reliable statistical difference as a function of the major variables, nor did these variables interact in determining the misses.

The performance on the old words indicates a complete absence of context effects. Words studied in pairs but tested as single words were not different on the number of misses from words presented singly and tested singly. Furthermore, instructions to associate words had no appreciable influence on misses. The variation that occurred as a consequence of the between-groups manipulation was primarily limited to the false alarms.

As discussed above, there was no evidence that IARs were elicited by the critical-stimulus words during testing. Another rough test of the possible elicitation of IARs during the test can be made by examining the number of misses on the critical-stimulus words. Although normative data are not available on the backward associations (e.g., thread to spool), it seems beyond doubt that bidirectional associations existed for many of the pairs. Therefore, when the IAR word was tested, it could have elicited its stimulus word. If the latter were tested after the IAR word, the number of misses should have decreased. Procedurally, this involves a comparison of misses during the two halves of testing for the critical-stimulus words. The data showed some increase in misses from the first half to the second half. The neutral old words showed little change from the first half to the second half. Because these neutral words could be considered as control words for the influence of IAR production during testing on the critical-stimulus words, it must be concluded that there is no evidence that the IAR words elicited their stimulus words during testing. It is not clear

why the critical-stimulus words showed an increase in misses across the test, whereas the neutral old words did not.

Discussion

The possibility that IARs are less likely to occur in studying pairs of words than in studying single words seems to have been thoroughly discredited by the outcome of the experiment. The acceptance of this conclusion requires a concomitant acceptance of the false-recognition method as a means of indexing the occurrence of the IARs at the time of study. In terms of the introductory comments, two implications follow from the finding.

First, the failure of IAR expectations to be supported in verbal-discrimination learning cannot reasonably be attributed to the lack of IAR production. It might be argued that the present procedures did not adequately match the situation faced by subjects given a verbal-discrimination task. That is, had we presented pairs for study, with a right and wrong word in each pair, with the usual instructions for verbal-discrimination learning, a test for IARs following a single trial might have given negative evidence on IAR production. We choose to believe that learning behavior cannot show such explicit isolation or specificity for relatively naive subjects, although we may be wrong in this belief. It should be pointed out that the number of false recognitions found in the present study is small in an absolute sense. It may well be that other discriminative information (e.g., frequency) produced by the verbal-discrimination task is of such

magnitude as to essentially swamp any information present due to IARs.

Second, the results indicate that theoretical thinking about paired-associate learning, in which IARs to the individual words enter as a part, has clear empirical support -- if anyone felt that such support was needed.

The results showed differences in number of false alarms among the four groups as seen in the interaction between instructions and type of presentation during study. We have not been able to formulate a coherent account of these differences. Criterion differences among the groups would not account for the findings because the number of misses was essentially uninfluenced by the two variables. As noted earlier, the instructional variable was introduced because we wanted subjects to associate the two words in the pairs in one case, and the other instructions were devised to minimize associative-learning attempts. But just how the subject went about his task under the non-associative instructions is not known.

From a broad point of view relative to the elicitation of IARs, there is one disturbing finding, namely, the failure to find any evidence that IARs were produced during the testing. Thus, we must support Cramer's (1970) conclusion that IAR production during testing is minimal, or at least not detectable by the methods available. It still remains possible that a subject can "turn off" IAR production. Or, it is possible that a study phase followed by a distinct test phase is responsible for a reduction in the amount of implicit semantic

elaboration which is presumed to occur during study. If this does occur, the reasons are not apparent to us.

References

Cramer, P. Semantic generalization: IAR locus and instructions. Journal of Experimental Psychology, 1970, 83, 266-273.

Hall, J. W., & Crown, I. Associative encoding of words in sentences by adults and children. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 92-95.

Kanak, N. J., Cole, L. E., & Eckert, E. Implicit associative responses in verbal discrimination acquisition. Journal of Experimental Psychology, 1972, 93, 309-319.

Schwartz, M. Instructions to use verbal mediators in paired-associate learning. Journal of Experimental Psychology, 1969, 79, 1-5.

Underwood, B. J., Reichardt, C. S., & Zimmerman, J. Conceptual associations and verbal-discrimination learning. American Journal of Psychology, 1973, 86, 613-615.

DISTRIBUTION LIST

Navy

4 Dr. Marshall J. Farr, Director
Personnel and Training Research Programs
Office of Naval Research (Code 458)
Arlington, VA 22217

1 ONR Branch Office
495 Summer St.
Boston, MA 02210
ATTN: Research Psychologist

1 ONR Branch Office
1030 East Green St.
Pasadena, CA 91101
ATTN: E. E. Gloye

1 ONR Branch Office
536 South Clark St.
Chicago, IL 60605
ATTN: M. A. Bertin

1 Office of Naval Research
Area Office
207 West 24th St.
New York, NY 10011

6 Director
Naval Research Laboratory
Code 2627
Washington, DC 20390

12 Defense Documentation Center
Cameron Station, Bldg. 5
5010 Duke St.
Alexandria, VA 22314

1 Special Assist. for Manpower
OASN (M&RA)
Pentagon, Room 4E794
Washington, DC 20350

1 LCDR Charles J. Theisen, Jr., MSC, USN
4024
Naval Air Development Center
Warminster, PA 18974

1 Chief of Naval Reserve
Code 3055
New Orleans, LA 70146

1 CAPT John F. Riley, USN
Commanding Officer
U.S. Naval Amphibious School
Coronado, CA 92155

1 CAPT Ouida C. Upchurch, USN
Program Coordinator
Bureau of Medicine & Surgery (Code 71G)
Washington, DC 20372

1 Chairman, Behavioral Science Dept.
Naval Command & Management Division
U.S. Naval Academy
Luce Hall
Annapolis, MD 21402

1 Chief of Naval Education & Training
Naval Air Station
Pensacola, FL 32508
ATTN: CAPT Bruce Stone, USN

1 Mr. Arnold Rubinstein
Naval Material Command (NAVMAT 03424)
Room 820, Crystal Plaza #6
Washington, DC 20360

1 Commanding Officer
Naval Medical Neuropsychiatric Research
San Diego, CA 92152

1 Director, Navy Occupational Task
Analysis Program (NOTAP)
Navy Personnel Program Support Activity
Bldg. 1304, Bolling AFB
Washington, DC 20336

1 Dr. Richard J. Niehaus
Office of Civilian Manpower Management
Code 06A
Washington, DC 20390

1 Dept. of the Navy
Office of Civilian Manpower Management
Code 263
Washington, DC 20390

1 Chief of Naval Operations (OP-987E)
Dept. of the Navy
Washington, DC 20350

1 Superintendent
Naval Postgraduate School
Monterey, CA 93940
ATTN: Library (Code 2124)

1 Commander, Navy Recruiting Command
4015 Wilson Blvd.
Arlington, VA 22203
ATTN: Code 015

1 Mr. George N. Graine
Naval Ship Systems Command
SHIPS 047C12
Washington, DC 20362

1 Chief of Naval Technical Training
Naval Air Station Memphis (75)
Millington, TN 38054
ATTN: Dr. Norman J. Kerr

1 Commanding Officer
Service School Command
U. S. Naval Training Center
San Diego, CA 92133
ATTN: Code 3030

1 Dr. W. L. Maloy
Principal Civilian Advisor for
Education & Training
Naval Training Command, Code 91A
Pensacola, FL 32508

1 Dr. Alfred F. Smode, Staff Consultant
Training Analysis &Evaluation Group
Naval Training Equipment Center
Code N-00T
Orlando, FL 32813

1 Dr. Hanns H. Wolff
Technical Director (Code N-2)
Naval Training Equipment Center
Orlando, FL 32813

1 Chief of Naval Training Support
Code N-21 Bldg. 45
Naval Air Station
Pensacola, FL 32508

1 Dr. Robert French
Naval Undersea Center
San Diego, CA 92132

1 CDR Richard L. Martin, USN
Fighter Squadron 124
NAS Miramar, CA 92145

1 Navy Personnel R&D Center
San Diego
California 92152

5 Navy Personnel R&D Center
San Diego, CA 92152
ATTN: Code 10

1 D. M. Gragg, CAPT, MC, USN
Head, Educational Programs Development
Dept.
Naval Health Sciences Education &
Training Command
Bethesda, MD 20014

Army

1 Headquarters
U.S. Army Admn. Center
Personnel Admn. Combat Development Activ
ATCP-HRO
Ft. Benjamin Harrison, IN 46249

1 Armed Forces Staff College
Norfolk, VA 23511
ATTN: Library

1 Director of Research
U.S. Army Armor Human Research Unit
Bldg. 2422 Morade St.
Ft. Knox, KY 40121
ATTN: Library

1 Commandant
U.S. Army Infantry School
ATTN: ATSH-DET
Fort Benning, GA 31905

1 Deputy Commander
U.S. Army Institute of Administration
Fort Benjamin Harrison, IN 46216
ATTN: EA

1 Dr. F. J. Harris
U.S. Army Research Institute
1300 Wilson Blvd.
Arlington, VA 22209

1 Dr. Ralph Dusek
U.S. Army Research Institute
1300 Wilson Blvd.
Arlington, VA 22209

1 Mr. Edmund F. Fuchs
U.S. Army Research Institute
1300 Wilson Blvd.
Arlington, VA

1 Dr. Leon H. Nawrocki
U.S. Army Research Institute
1300 Wilson Blvd
Arlington, VA 22209

1 Dr. J. E. Uhlaner, Technical Director
U.S. Army Research Institute
1300 Wilson Blvd
Arlington, VA 22209

1 Dr. Joseph Ward
U.S. Army Research Institute
1300 Wilson Blvd
Arlington, VA 22209

1 HQ USAREUR & 7th Army
ODCSOPS
USAREUR Director of GED
APO New York 09403

Air Force

1 Research Branch
AF/DPMYAR
Randolph AFB, TX 78148

1 Dr. G.A. Eckstrand (AFHRL/AS)
Wright-Patterson AFB
Ohio 45433

1 Dr. R. L. Morgan (AFHRL/AST)
Wright-Patterson AFB
Ohio 45433

1 AFHRL/DOJN
Stop #63
Lackland AFB, TX 78236

1 Dr. Martin Rockway (AFHRL/SM)
Lowry AFB
Colorado 80230

1 Major P.J. DeLeo
Instructional Technology Branch
AF Human Resources Laboratory
Lowry AFB, CO 80230

1 AFOSR/NL
1400 Wilson Blvd.
Arlington, VA 22209

1 Commandant
USAF School of Aerospace Medicine
Aeromedical Library (SUL-4)
Brooks AFB, TX 78235

1 Dr. Sylvia R. Mayer (MCIT)
Headquarters Electronic Systems Division
LG Hanscom Field
Bedford, MA 01730

1 Capt. Jack Thorpe, USAF
Flying Training Division (HRL)
Williams AFB, AZ 85224

Marine Corps

1 Mr. E. A. Dover
Manpower Measurement Unit (Code MPI)
Arlington Annex, Room 2413
Arlington, VA 20380

1 Commandant of the Marine Corps
Headquarters, U.S. Marine Corps
Code MPI-20
Washington, DC 20380

1 Director, Office of Manpower Utilization
Headquarters, Marine Corps (Code MPU)
MCB (Bldg. 2009)
Quantico, VA 22134

1 Dr. A. L. Slafkosky
Scientific Advisor (Code RD-1)
Headquarters, U.S. Marine Corps
Washington, DC 20380

Coast Guard

1 Mr. J. J. Cowan, Chief
Psychological Research Branch (G-P-1/62)
U.S. Coast Guard Headquarters
Washington, DC 20590

Other DOD

1 Lt. Col. H. L. Taylor, USAF
Military Assistant for Human Resources
OAD (E&LS) ODDR&E
Pentagon, Room 3D129
Washington, DC 20301

1 Mr. W. J. Stormer
DOD Computer Institute
Washington Navy Yard, Bldg. 175
Washington, DC 20374

1 Col. Austin W. Kibler
Advanced Research Projects Agency
Human Resources Research Office
1400 Wilson Blvd.
Arlington, VA 22209

1 Mr. Thomas C. O'Sullivan
Advanced Research Projects Agency
Human Resources Research Office
1400 Wilson Blvd.
Arlington, VA 22209

1 Helga L. Yeich
Advanced Research Projects Agency
Manpower Management Office
1400 Wilson Blvd.
Arlington, VA 22209

Other Government

1 Dr. Eric McWilliams, Program Manager
Technology and Systems, TIE
National Science Foundation
Washington, DC 20550

1 Dr. Andrew R. Molnar
Technological Innovations in Education
National Science Foundation
Washington, DC 20550

1 Dr. M. S. Smith, Asst. Acting Director
Program on Essential Skills
National Institute of Education
Brown Bldg., Room 815
19th and M St., N.W.
Washington, DC 20208

Miscellaneous

1 Dr. S. B. Anderson
Educational Testing Service
17 Executive Park Dr., N.E.
Atlanta, GA 30329

1 Dr. John Annett
The Open University
Milton Keynes
Buckinghamshire
ENGLAND

1 Dr. R. C. Atkinson
Stanford University
Dept. of Psychology
Stanford, CA 94305

1 Dr. Gerald V. Barrett
University of Akron
Dept. of Psychology
Akron, OH 44325

1 Dr. Bernard M. Bass
University of Rochester
Management Research Center
Rochester, NY 14627

1 Dr. D. G. Bowers
University of Michigan
Institute for Social Research
Ann Arbor, MI 48106

1 Mr. K. M. Bromberg
Manager - Washington Operations
Information Concepts, Inc.
1701 North Fort Myer Dr.
Arlington, VA 22209

1 Dr. D. P. Carver
School of Education
University of Missouri
Kansas City, MO 64110

1 Centry Research Corp.
4113 Lee Highway
Arlington, VA 22207

1 Dr. A. M. Collins
Bolt, Beranek & Newman, Inc.
50 Moulton St.
Cambridge, MA 02138

1 Dr. H. P. Dachler
University of Maryland
Dept. of Psychology
College Park, MD 20742

1 Dr. Rene' V. Dawis
University of Minnesota
Dept. of Psychology
Minneapolis, MN 55455

1 Dr. Robert Glaser, Director
University of Pittsburgh
Learning Research & Development Center
Pittsburgh, PA 15213

1 Dr. M. D. Havron
Human Sciences Research, Inc.
7710 Old Spring House Rd.
West Gate Industrial Park
McLean, VA 22101

1 HumRRO
Division No. 3
P.O. Box 5787
Presidio of Monterey, CA 93940

1 HumRRO
Division No. 4, Infantry
P.O. Box 2086
Fort Benning, GA 31905

1 HumRRO
Division No. 5, Air Defense
P.O. Box 6057
Fort Bliss, TX 79916

1 Dr. Lawrence B. Johnson
Lawrence Johnson & Assoc., Inc.
200 S. St. N.W., Suite 502
Washington, DC 20009

1 Dr. M. S. Katz
MITRE Corp.
Westgate Research Center
McLean, VA 22101

1 Dr. S. W. Keele
University of Oregon
Dept. of Psychology
Eugene, OR 97403

1 Dr. David Klahr
Carnegie-Mellon University
Dept. of Psychology
Pittsburgh, PA 15213

1 Dr. Alma E. Lantz
University of Denver
Denver Research Institute
Industrial Economics Division
Denver, CO 80210

1 Dr. Robert R. Mackie
Human Factors Research, Inc.
6780 Cortona Dr.
Santa Barbara Research Park
Goleta, CA 93017

1 Dr. D. A. Norman
University of Calif.
Center for Human Information Processing
LaJolla, CA 92037

1 Mr. Brian McNally
Educational Testing Service
Princeton, NJ 08540

1 Mr. A. J. Pesch, President
Eclectech Assoc., Inc.
P.O. Box 178
North Stonington, CT 06359

1 Mr. Luigi Petrullo
2431 N. Edgewood St.
Arlington, VA 22207

1 Dr. J. W. Rigney
University of Southern California
Behavioral Technology Laboratories
3717 S. Grand
Los Angeles, CA 90007

1 Dr. L. L. Rosenbaum, Chairman
Montgomery College
Dept. of Psychology
Rockville, MD 20850

1 Dr. G. E. Rowland
Rowland & Co., Inc.
P.O. Box 61
Haddonfield, NJ 08033

1 Dr. Arthur I. Siegel
Applied Psychological Services
404 E. Lancaster Ave.
Wayne, PA 19087

1 Dr. C. H. Stone
1428 Virginia Ave.
Glendale, CA 91202

1 Mr. Dennis J. Sullivan
725 Benson Way
Thousand Oaks, CA 91360

1 Dr. David J. Weiss
University of Minnesota
Dept. of Psychology
Minneapolis, MN 55455

1 Dr. Anita West
Denver Research Institute
University of Denver
Denver, CO 80210

1 Dr. Kenneth N. Wexler
University of California
School of Social Sciences
Irvine, CA 92664